

# Conserving Threatened and Endangered Species

*“The strength of each country’s conservation ethic is measured by the wisdom and effectiveness of its legislation in protecting biodiversity. Without dispute the most important conservation law in the history of the United States is the Endangered Species Act.”*

—E. O. Wilson,  
*The Future of Life*

A great many of the national parks were set aside for conservation because of their spectacular natural beauty. The National Park Service took them in as a whole, and now we are beginning to understand how the parts function and interact. Passed 30 years ago, the Endangered Species Act contributes to park preservation goals by helping to ensure that the biotic parts of these ecosystems are not lost. The job begins with knowing what is in the parks and regularly assessing how the populations of federally listed species are faring. That information is compiled in the NPS Endangered Species Act database, which is now on a website available to NPS staff. With this information, we can determine which species are recovering and focus our efforts on those that continue to decline or restore those that have been lost from the parks. A growing number of species are being restored successfully, and a few of their stories follow in this chapter. For the future we will continue to increase our knowledge of these rare populations of plants and animals and take action when needed to secure their persistence in the national parks.



Formerly widespread on the island of Hawaii, Mauna Loa silversword, a federally listed endangered plant species, declined primarily as a result of disturbance by feral pigs, goats, and mouflon sheep. Hawaii Volcanoes National Park has been fenced to keep out these nonnative species and as of November 2003 had planted 6,800 seedlings over three years, with 83% survival. The core of the restored plants are within two 30-acre (12-ha) exclosures, which provide additional protection from feral animals.

# Progress on threatened and endangered species in national parks

By Peter A. Dratch



For the protection of the federally endangered Eureka Dunes evening-primrose, in 2003, staff at Death Valley National Park closed a portion of a park road, relocated a campground, and scarified compacted soils to promote natural reseeding of the plants. A combination of grants and funds from the Recreation Fee Demonstration Program paid for the project.

Table 1. Number of federally listed species in the National Park System listed by status and the number of current or historical populations in national parks		
Status Trend in National Parks	Number of Species	Number of Populations
Endangered	200	597
Threatened	84	419
Experimental	3	13
Proposed	4	9
Candidate	51	84
Total	342	1,122

Table 2. Number of endangered, threatened, proposed, and candidate species and populations in the National Park System by taxon		
Group	Number of Species	Number of Populations*
Plants	148	244
Mammals	39	243
Birds	50	337
Reptiles	18	124
Amphibians	6	9
Fish	35	100
Invertebrates	46	65
*Number of populations reflects both current and historical populations in parks.		

THROUGH TARGETED RESTORATION projects and training at the regional and national levels, national parks have an increasingly important role in species recovery under the Endangered Species Act (ESA). In the past year, 284 endangered or threatened species of plants and animals were recorded on lands managed by the National Park Service, with another 55 species either proposed for or designated as candidates for listing (table 1). An additional 246 populations have historically existed in parks, and in many cases these could be restored.

Plants remain the largest category of listed species in the national parks (table 2) and are increasingly the target of recovery efforts funded by the Natural Resource Preservation Program (NRPP). Mauna Loa silversword (*Argyroxiphium kauense*) was reestablished at Hawaii Volcanoes National Park with NRPP funds designated for threatened and endangered species this year, and three of the top four projects chosen for FY 2005 funding were for plant restorations—the fourth was for the dwarf wedgemussel, a mollusk. The NPS Endangered Species Act database details the status and trends of these

species in each park. It not only suggests potential restoration projects, but also enables park staff to evaluate progress toward their goals for these species.

Although the Pacific West Region has the greatest number of federally listed species and park populations, all regions have listed species that require particular management attention (table 3). Some solutions that benefit these species are implemented by parks on their own. For example, at Death Valley National Park (California and Nevada), a road and a campground occupied habitat of two endangered plants, the Eureka Dunes evening-primrose (*Oenothera californica* ssp. *eurekensis*) and the Eureka Valley dune grass (*Swallenia alexandrae*),

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**Table 3. Number of federally listed, proposed, and candidate species and populations in each region of the National Park System, and the park within each region with the most of those species**

Region Populations	Number of Species	Number of Populations
Alaska (Kenai Fjords National Park)	10	14
Intermountain (Capitol Reef National Park)	70	247
Midwest (Indiana Dunes National Lakeshore)	22	99
National Capital (C&O Canal, Prince William Forest Park, and Rock Creek Park)	4	19
Northeast (Gateway National Recreation Area)	24	61
Pacific West (Haleakala National Park)	194	391
Southeast (Everglades National Park)	104	291

**Table 4. Population trends of federally listed, proposed, and candidate species in the National Park System for 2002**

Status Trend in National Parks	Number of Populations	Percentage of Populations
Not at risk	82	7.2
Stable	225	19.9
Increasing	93	8.2
Declining	101	8.9
Extirpated	204	18.0
Unknown	402	35.5

in addition to six endemic beetles, one endemic bee, and several other special-status plants. After consulting the U.S. Fish and Wildlife Service and addressing provisions of the National Environmental Policy Act, the park closed a portion of the road, relocated the campground, and scarified the ground to promote reseeding of the plants. A combination of grants and funds from the Recreation Fee Demonstration Program paid for the project.

Park personnel took advantage of training offered at the national and regional levels for techniques in managing listed species. “Scientific Principles and Techniques for Endangered Species Management” was offered for the first time at the Horace M. Albright Training Center in February. The course was a joint effort with the U.S. Fish and Wildlife Service, with instructors and students coming from both bureaus. A one-day course, “Modern Genetics for Resource Managers,” was held in conjunction with the George Wright Society meeting in San Diego in the spring. The genetics examples came from studies conducted in national parks and demonstrated how new molecular research methods could answer population questions that are important to management. Section 7 consultation training (Endangered Species Act) was offered several times in the Intermountain Region, and plans are under way to bring this course to other regions.

The National Park Service is directing more of its funding to listed species whose need is most immediate: this year the amount spent on declining and extirpated populations went up, while dollars spent on stable and increasing species went down. (Money is spent on extir-

pated populations in preparation for their restoration.) To continue this trend, management summaries have now been completed for almost all of the threatened and endangered species that occur in the national parks. They relate basic biological information in addition to the recovery goals for the species on a website in a form that is accessible to resource managers.

The NPS ESA database summary clearly points to areas where the National Park Service can improve with respect to threatened and endangered species. The number of populations where parks reported the status as unknown remains at about 35% (table 4). One way parks can reduce this percentage is through coordination with the Inventory and Monitoring Program because listed species are a priority in many Vital Signs monitoring plans. ■

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# Condors on the Colorado Plateau reach new heights

By Elaine F. Leslie

ON THE SOUTH RIM of Grand Canyon National Park, Arizona, high in a band of Redwall Limestone, a six-month-old California condor chick dances on the edge of a precipice overlooking the Colorado River. In March 2003, biologists first suspected that condors #123 and #127 were incubating an egg. (California condor studbook identification numbers signify the bird's parentage, genetic integrity, and diversity.) Although biologists and Nestwatch volunteers had continually monitored the parents' activity and behavior since suspecting there was an egg, the chick could not be confirmed until it moved to the entrance of the cave at five months of age. The only way to see the nest site, which rests 800 feet (244 m) above the ground, is to take an arduous 12-mile hike into the canyon. Park biologists observed the chick stretching out its long wings and flapping without lifting off, in preparation for the day in late October or early November when it would step beyond its rocky nursery.

Over the past 10 years, condors have been restored to several locations in California and Arizona, and the California population of condors hatched one wild chick in 2003. But during a nest site cleanup, the bird appeared emaciated and stunted and had to be emergency airlifted from its nest cave and later euthanized. The condor's parents had brought trash—glass, metal conductors, and bottle caps—into the site, apparently simulating the feeding of calcium supplements, which are a requirement of the condor diet. However, a chick cannot pass the foreign objects through its system; respiratory damage occurred, resulting in pneumonia.

The dietary necessity of calcium supplements, which has persisted for thousands of years, was revealed during analyses of nest contents from an earlier failed nest site at Grand Canyon. Investigators discov-

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ered calcium bone fragments brought in by adult condors from a much earlier period: Pleistocene remains of horse, bison, and musk ox. These particles were found in the nest in a layer beneath this year's collection, which also included the bottle caps and glass.

Biologists participating in the multiagency cooperative effort closely monitored feather development, crop size, and activity levels of Grand Canyon chick #305. As it neared fledging from its lofty perch, biologists remained cautiously optimistic.

The monumental flight finally occurred at 1:30 p.m. on November 5, 2003. The chick jumped from the cave, looked for a nearby landing perch, and realizing there was none, ungracefully circled and landed about 600 feet (183 m) below the cave.



Biologists and volunteers at Grand Canyon National Park waited anxiously from March until November 2003 when the condor chick fledged, the first time for this occurrence in the canyon in at least 100 years. Condor #305 marks the first successful fledging of a condor in the wild in North America since the 1980s.

Having a condor hatch and fledge in the wild—something that has not happened anywhere since 1984 and not in the Grand Canyon for at least 100 years—is indeed a measure of success. However, wild rearing of the chick and protection from human-caused and environmental contaminants ultimately will determine long-term preservation of this species, which has been brought back from the brink of extinction. ■

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## NPSFACT

Of the 1,122 populations of endangered species\* that occurred historically in national parks, 244 (more than 20%) are now gone. However, because the habitats for many of these species are preserved in the parks, opportunities exist for their restoration. Recent successful restorations include trailing phlox in Big Thicket National Preserve, the wolf in Grand Teton National Park (via Yellowstone), and the Mauna Loa silversword in Hawaii Volcanoes National Park.

*\*This total includes federally listed threatened and endangered species, in addition to species that are proposed and candidates for listing under the Endangered Species Act.*



# California condor returns to Pinnacles National Monument

By Cicely Muldoon and Rebecca Leonard

*Aside from geological and scenic interest, [Pinnacles National Monument] is important as one of the last strongholds and breeding places of the California condor.*

—Guide to the National Monuments, ca. 1930

AFTER FOUR YEARS of planning, and four years short of the park's centennial, Pinnacles National Monument, in cooperation with the Ventana Wilderness Society and the U.S. Fish and Wildlife Service, has brought the California condor home. One adult and six juvenile condors resided in a newly constructed facility designed to house the birds while they became familiar with Pinnacles' rugged terrain. The young condors were hatched at the San Diego Wild Animal Park, housed at the Big Sur release site in central California for five months, and transferred to Pinnacles in mid-September 2003. The juvenile birds spent three months in the release facility with the adult mentor condor. Two of the juveniles were released on December 20, 2003, with four more following on January 5. By January 26, following the recapture of two condors that had been roosting on the ground and were vulnerable to predation, all six juveniles were flying free in the monument.

Park staff overcame many hurdles to return condors to this part of their historical range, including two environmental assessments, extended public review, and an unexpected relocation of the release

*“Park staff has worked hard to build understanding and support for the condor reintroduction program with neighboring landowners and surrounding communities.”*

site. Working through the logistics for the new release site, which included bringing water to a roadless area, carrying innumerable loads of construction materials up steep terrain, and working with neighboring landowners to construct an access trail across private property, slowed the project by more than a year. Fortunately, with the strong support of park neighbors and project partners, the return of the California condor to the park is back on track. Following the successful release of the first six California condors at Pinnacles, another cohort of juveniles will be transferred to the facility and held for release in fall 2004. The release program will continue over a projected 3- to 15-year period, depending upon how soon the goal of a wild population of 20–30 condors within the park is achieved.

Staff's hopes that the park will be a viable release site are high. Park features bear promising names for the reintroduction—Condor Gulch, Condor Crag—and Pinnacles' craggy volcanic formations are excellent, historical condor nesting habitat. Condors are believed to have nested within the park until the 1930s, and the last confirmed condor sighting was in 1982. With the ability to fly more than 200 miles (322 km) a day, and with resident wild condors only 45 miles (72 km) away on the Big Sur coast, time will tell if the condors released at Pinnacles will once again take up residence in the rugged formations of the 24,000-acre (9,720-ha) park.

If successful, Pinnacles National Monument will be the most accessible of all the condor release sites and a destination for those hoping for a glimpse of one of the rarest and most notorious birds



A vulture with a 9.5-foot (2.9-m) wingspan, the California condor is the largest flying bird in North America. The juvenile birds warm their wings in the morning sun.

in the United States. The monument is only 100 miles (161 km) south of the greater San Francisco Bay Area, which has a burgeoning population in the millions. The park is located in the heart of San Benito County, however, one of the least populated and most rural counties in California. Large private ranchlands surround the park, and hundreds of thousands of acres of public lands are nearby. Park staff has worked hard to build understanding and support for the condor reintroduction program with neighboring landowners and surrounding communities through ongoing education and outreach.

A successful condor reintroduction at Pinnacles will, of course, be only a piece of the larger strategy for recovery of this remarkable species, including numerous federal and state agencies, and private and nonprofit organizations. Release is just the first step in the ultimate success of the condor program. Once condors are again soaring over Pinnacles, they will face numerous hazards and challenges, both natural and human-related. Predators such as coyotes and golden



An adult condor named Hoi, distinguished by his pinkish-orange head and neck (above), lived with the six juvenile birds, teaching them skills needed for survival in the wild.

eagles pose a moderate risk to the birds' survival. Much greater is the danger posed by humans. The preeminent threat to condors is lead poisoning, caused by consumption of lead-contaminated carcasses or gut piles left behind by hunters. Few people are aware of the danger lead poses to condors, or of the solutions that could overcome these hazards. These threats can be mitigated through the use of lead-free ammunition or burying animal remains, and a comprehensive educational effort is a focus of all agencies and organizations engaged in the condor recovery program. Collision with utility lines is another danger to condors because they have difficulty seeing them. Small, inexpensive diverters have been used effectively in release areas to make the lines more visible. Despite these and other obstacles, successful recovery of the species is possible. Captive-bred condors fledged a chick this fall in the Grand Canyon, the first wild fledgling of this species in the wild since the mid-1980s, and a milestone in the overall condor recovery effort.

Ultimately, bringing the condors home to western North America will depend on an informed and engaged public committed to their return. The staff at Pinnacles welcomes the opportunity to serve as a critical link in the recovery effort. ■

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## Reproduction of Canada lynx discovered in Yellowstone

By Tiffany Potter



Yellowstone National Park, Wyoming, has confirmed the presence of a female Canada lynx and her kitten in the central portion of the park. Staff members of the Yellowstone lynx project were jubilant when, with a snowstorm looming, they located snow tracks of a lynx and her cub on an extremely cold day (below  $-20^{\circ}\text{F}$ ,  $-29^{\circ}\text{C}$ ) in February 2003. A goal of the lynx project is to determine if Yellowstone

has a resident population of this elusive animal, and this discovery suggests that the animals are resident rather than transient.

With more than 50 pounds of survival and tracking gear, biologists on skis followed the tracks for 2.2 miles (3.5 km), measuring tracks, taking plaster casts, and collecting hair and fecal samples for

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*“This discovery is the first documented case of reproduction of lynx in Wyoming since 1998.”*

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DNA analysis. Scientists at the University of Montana's Rocky Mountain Research Laboratory extracted DNA from the samples and identified the source of the hair and scat as lynx. The Rocky Mountains Cooperative Ecosystem Studies Unit has an agreement with the genetics laboratory to identify species and gender of forest carnivores from hair and scat samples submitted by the National Park Service. The presence of Canada lynx was first recorded from DNA from hair snared in summer 2001; however, questions remained as to whether lynx were visitors to or residents of Yellowstone.

This discovery is the first documented case of reproduction of lynx in Wyoming since 1998. In the summer, reproduction was also documented in six lynx females that were reintroduced to southwestern Colorado. These reproducing lynx represent an important success for this species, which is listed as threatened across its range in the contiguous United States. Scientists still have questions about the long-term survival of lynx offspring and their ability to be recruited into the population. Documenting a small population of lynx in Yellowstone could be an impetus for additional study. ■

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# Dragonflies and damselflies: Invertebrate indicators of ecological health

By Carol DiSalvo, Richard Orr, and David Foote

INVERTEBRATES, magnificent spineless creatures that few people ever ponder in a positive way, constitute the bulk of biological diversity on Earth and in our national parks. They dominate every global ecosystem in terms of species richness, biomass, and ecological function and are the foundation of every food chain, inhabiting niches from caves to the Arctic. Invertebrates play essential and remarkably diverse roles as decomposers, food sources, herbivores, dispersal agents, and pollinators. And they are important indicators of ecosystem health.

Despite their importance and abundance, invertebrates have been largely overlooked. Research focusing on this huge taxonomic group has been poorly funded compared with the study of more charismatic species such as mammals, birds, and fish. Fortunately, the critical importance of invertebrates is finally being acknowledged thanks to brilliant ecologists and enthusiasts such as E. O. Wilson and a handful of exceptional and pioneering natural resource managers of the Department of the Interior. These stewards are demonstrating how surveys of invertebrates can help park managers evaluate and detect change in ecosystem health and biodiversity.

Dragonflies and damselflies, of the order Odonata, are well-known invertebrates and are of great ecological importance. The odonates comprise a significant animal component of aquatic environments. As insect predators low in the food chain, odonates reflect changes in the health of aquatic ecosystems much faster than can be recognized through monitoring most other animal or plant groups. Using these

indicator species in baseline surveys provides a measure of the current health of the various aquatic systems in a park and is an excellent monitoring tool for predicting future changes in those environments.

Furthermore, information on the presence and function of damselflies and dragonflies in national parks is important if an ecosystem approach to management is to be successful. Yet, to date, only a handful of parks have begun this type of monitoring.

Eastern North America is one of the global hot spots of dragonfly biodiversity and an ideal region for realizing the potential of monitoring odonates. One of the first surveys of this type is occurring at Harpers Ferry and C&O Canal National Historical Parks, and Rock Creek Park. Increasing concern about the consequences for nontarget species of proposed insecticide used to combat West Nile Virus has led resource managers to initiate a three-year study of odonates. The survey has begun to describe the distribution and abundance of species, including those that are rare, threatened, or endangered. This baseline information may help delineate risks and avoid unnecessary insecticide treatments. Odonates are the most common and conspicuous animals around the aquatic wetlands of the three parks, and more than 90 species were identified in the first field season of the survey. This includes a number of state-listed species and the first location of viable populations of mocha emerald and clamp-tipped emerald dragonflies (*Somatochlora linearis* and *S. tenebrosa*, respectively) in the District of Columbia. Although the study is not complete, scientists expect that additional state- and district-listed rare or threatened species will be found.

In the West, Carlsbad Caverns National Park announced in July the discovery of a rare damselfly, *Argia leonorae*, not previously known in New Mexico. A University of Texas biology class led by John Abbott made the discovery. Abbott and his students found a single adult male, which is blue in color. Known as Leonora's dancer, it is named for Leonora Gloyd, who studied North American damselflies for 50 years. This species was federally listed as rare in 1996 and is thought to be extirpated from its only population in Texas, 100 miles south of the park, because of habitat changes.

The Hawaiian Islands host 36 species of odonates, including an entire genus of 25 damselflies (*Megalagrion* species) that are unique to the islands. The two endemic Hawaiian dragonflies, the Blackburn dragonfly (*Nesogonia blackburni*) and the giant Hawaiian dragonfly (*Anax strenuus*), are common to remote montane forest streams. In contrast, a number of the *Megalagrion* damselflies have become rare, especially in lowland habitat. Six of these *Megalagrion* species are under consideration for listing under the Endangered Species Act.

The Hawaiian damselflies represent a remarkable instance of ecological diversification during their evolution on the islands. Some *Megalagrion* damselflies are found at traditional breeding sites such as stream edges and freshwater pools, but others occur in very unusual settings. For instance, many breed on freshwater seeps that flow across moss-covered rocks well above a stream, in some cases along the edge



The larval *Megalagrion koelense* damselfly (above) perches on the leaf of a native Hawaiian lily where it completes its life cycle by preying on other insects.



The Hawaiian damselfly *Megalagrion koelense* (adult male depicted, left) breeds in leaf pockets of native lilies.

Hawaiian damselflies *Megalagrion calliphya* perch on emergent aquatic vegetation (below). The red male holds on to the green female while she inserts eggs into the plant stem.





of waterfalls. Even more amazing are two semiterrestrial species that have abandoned streams altogether and breed in water that collects in the bases of leaves of climbing vines and lilies. The larvae use these small pockets of water to capture and feed on other insects and small snails. The most extreme case is the completely terrestrial *Megalagrion oahuense*, a Hawaiian damselfly that has abandoned not only the streams but also the leaf pockets. Its hairy larvae live in damp leaf litter under banks of uluhe ferns in the wet upper-elevation rainforests on the island of Oahu. This species has completely lost the ability to breed in water.

The diversity of breeding habitats among *Megalagrion* damselflies has recently been used by researchers with the U.S. Geological Survey at Hawaii Volcanoes National Park. USGS ecologists are measuring how communities of damselflies change in response to moisture stress and temperature change. They are observing systematic shifts in damselfly community composition associated with changing hydrologic conditions. In this way, Hawaiian damselflies are serving as a focal group to better understand the consequences of long-term climate change.

Major threats to Hawaiian damselflies include habitat degradation and alien species introductions. Lower- and mid-elevation aquatic habitats are often invaded by alien fish that prey on the damselfly larvae. On Oahu, the endemic orange-black damselfly (*M. xanthomeles*)

is a proposed threatened species and the focus of ongoing conservation efforts. It is being restored to low-elevation breeding sites that are free of alien fishes, and is also being studied at Kaloko Honokohau National Historical Park on the island of Hawaii, where the species breeds in rare coastal pools that are threatened by upslope industrial development. This is another example of how *Megalagrion* can serve as sentinels of ecosystem health in a wide range of unique habitats in national parks of Hawaii.

The odonates are important ecological, scientific, and educational park resources. Information from inventory and monitoring applied to management practices will reduce risks to odonates and other invertebrates and their habitats. In addition, this information is valuable for addressing threatened and endangered species issues and the conservation, planning, and management of freshwater aquatic ecosystems. ■

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## award-winner

### Doug Smith heads wolf restoration project

For his leadership in the restoration of the gray wolf in the northern Rocky Mountains, Dr. Doug Smith received the Director's Award for Natural Resource Management. As Wolf Project leader, Doug has played a major role in the success of this venture. (See *Natural Resource Year in Review—2001*, page 51.) This project serves as a model for how to restore, manage, monitor, and live with a large predator, and has far-reaching implications for the restoration of wildlife worldwide.

When the wolves were first brought from Canada in 1995 and 1996, Doug managed their care in the acclimation pens and has continued to do so since their release, developing procedures to restrict human use around active wolf dens, managing nuisance wolves outside the park, and investigating wolf fatalities. Monitoring wolves is difficult but crucial to this project. Doug devised innovative long-term wolf monitoring and research procedures. His winter study strategy has allowed investigators

to closely observe wolves making kills and interacting among themselves and with other species. These data have led to the development of statistical methods for estimating how often wolves kill large prey.

Armed with this kind of information, Doug and fellow project advocates can rebut charges from angry opponents of the project that the wolves are decimating the elk herds, and that their population is exploding. His many outreach activities are important for winning support and raising funds. He is an educator about wolves, making presentations to lay audiences, teaching wildlife education courses, mentoring graduate students, and contributing articles to journals and books. He has integrated more than 150 volunteer scientists into the park's management and research programs, and through the Yellowstone Visiting Scholars Program has welcomed wildlife biologists from around the country and abroad.



Dr. Doug Smith receives the Director's Award for Natural Resource Management from Dr. Lee Talbot, a coauthor of the Endangered Species Act, and Yellowstone Center for Resources Director John D. Varley.

Growing up in rural Ohio, Doug says, "My interest in nature and remote places was nurtured by my father and then focused on wolves when my brother bought me the classic book *The Wolf* by L. David Mech," prompting him, at age 16, to write Mech asking for a job. Now, a few decades later, young people are contacting Doug with aspirations of working with wildlife in remote places. ■



# Tracking bull trout in Olympic National Park, Washington

By Samuel J. Brenkman and Stephen C. Corbett

THE MIGRATORY PATTERNS of bull trout (*Salvelinus confluentus*) are the focus of an ongoing three-year study in the Hoh River of Olympic National Park in Washington. The bull trout is a member of the salmon family, related to Pacific salmon, trout, and Dolly Varden. Though the bull trout has declined throughout most of its historical range and is federally listed as threatened, its status and biology in national parks within its range remain largely unknown. Research in the last decade reveals that declines in distribution and abundance are due to degradation of freshwater habitats, overfishing by recreational anglers, hydroelectric dams, irrigation projects, and displacement by nonnative fish species. Olympic National Park contains some of the last remaining undisturbed habitat throughout the entire range of bull trout. However, bull trout in the park have been negatively influenced by land-use activities adjacent to the park boundary coupled with mortality associated with recreational and tribal fisheries directed at Pacific salmon and steelhead.

One critical question related to the life history of bull trout is whether populations with access to the ocean exhibit diadromy, or migration between freshwater and marine environments. The potential for diadromy in bull trout exists in large, free-flowing river systems that originate in Olympic National Park. In the current study, radiotelemetry was used to determine migratory patterns of adult bull trout in the Hoh River Basin. The primary objectives were to determine seasonal movements of adult bull trout, location and timing of spawning, use of estuarine and marine waters, and extent of use of tributary streams.

## Unlike Pacific salmon, bull trout

- Live longer—13 or more years
- Exhibit light-colored spots on a dark body
- Prey primarily on other fish species
- May spawn multiple times throughout their life history
- Exhibit nonmigratory and migratory life history forms
- Are more elusive and secretive (juveniles are observed mostly at night)
- Require the cleanest and coldest water of any salmonid in North America

From July 2002 to June 2003, a total of 82 adult bull trout, ranging from 16 to 28 inches long (40 to 70 cm), were captured at various locations in the Hoh River, South Fork Hoh River, and Kalaloch Creek; outfitted with radio transmitters; and safely released. Transmitters, each with a unique code allowing individual fish to be identified by their signal, were inserted into the body cavity through a small incision. Movements were tracked using five fixed stations strategically located and evenly distributed throughout the watershed. Each station includes two directional antennas, a receiver, and amplifiers that detect

upstream or downstream movements of individual fish. In addition, fish were tracked weekly by boat or from the riverbank and biweekly from the air, covering 62 miles (100 km) of the Hoh River and its tributaries, 155 miles (250 km) of the Pacific Coast, and the lower portions of numerous coastal rivers and creeks.

Bull trout implanted in the Hoh River exhibited complex seasonal movements. In the first year of the study, three general patterns of movement emerged: (1) upstream migration during the presumed spawning period from September to November; (2) downstream movement into the lower river followed by prolonged periods of residence;



Federally listed as a threatened species, bull trout in the Hoh River Basin of Olympic National Park have been shown to migrate in complex patterns that include moving from freshwater to marine environments. These preliminary research findings suggest potential vulnerability to recreational and gill-net fisheries that target salmon and steelhead.

and (3) emigration by 51% of implanted fish downstream into the estuary, the Pacific Ocean, and for some fish, into the lower reaches of other coastal rivers and streams outside the Hoh Basin.

Radiotelemetry has proven to be an effective method to determine movements of adult bull trout in logistically difficult terrain. This investigation provides the first information on bull trout migrations in a largely unaltered coastal river and the first verification of diadromy for the species. Initial data on seasonal movements and habitat use identify potential vulnerability to recreational and gill-net fisheries that target salmon and steelhead throughout the year. Bull trout may be susceptible to incidental harvest based on the following life history attributes: (1) extensive movement to and from saltwater and entry into multiple rivers where fisheries exist; (2) timing of outmigration from December to March and entry into the river that coincides with salmon and steelhead harvest seasons; and (3) longevity and capacity for repeat spawning, which increase the number of possible encounters with fisheries. The effects of fishing mortality at the population level remain unknown. The final report for this study will provide in-depth analysis of migratory patterns, habitat use, spawn timing and location, and effects of harvest, leading to the establishment of appropriate conservation and recovery strategies for this species. ■

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# Restoring federally endangered harperella along waterways in the National Capital Region

By Elizabeth Fortson Wells and Dianne Ingram

**IRREVOCABLE CHANGES** in the hydrologic cycles of eastern rivers and streams have imperiled harperella (*Ptilimnium nodosum*), a small member of the carrot family. Federally listed since 1988, harperella is the only endangered plant species in the National Capital Region. Over the past 90 years, harperella populations have been located, and subsequently extirpated, three times in the Chesapeake and Ohio Canal National Historical Park (Maryland). The park, which provides historical and potential habitat for harperella, experiences annual floods that may cause two extreme changes: “founder” events and extinction events. That is, new harperella populations are established while local populations become extinct. These dynamic founder-extinction events make watershed-level conservation necessary for this species.

In 2001, park managers initiated restoration and recovery efforts for harperella by surveying for extant populations and collecting seeds. In 2002 the lead scientist on the restoration project, Dr. Elizabeth Wells, began germination and seedling-growth experiments using harperella seeds collected from neighboring lands. During these successful experiments, germination took place at moderate temperatures over two to three weeks.

In summer 2003, Wells began characterizing and searching for suitable riparian habitat to reintroduce harperella populations. Harperella has very particular site requirements, specifically gravel bars that have full sun during most of the day, which few areas on parkland meet. Gravel bars simultaneously offer protection from

severe erosion while receiving occasional scouring events. The plant requires a narrow range of water depths (neither too deeply submerged nor too high above the water) during critical parts of the growing season. As disturbed and scoured areas, the bars also provide suitable habitat for exotic species.

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The Exotic Plant Management Team from the National Capital Region has been instrumental in this restoration effort. At selected planting sites, team members mapped vegetation, classified species, and helped prepare the sites for planting by removing aggressive exotics such as Japanese knotweed (*Polygonum cuspidatum*).

During periods of low water in July and August 2003, which corresponded to natural seed drop by harperella in the area, Wells planted viable seeds into five plots at selected sites along the Potomac River. Extensive flooding occurred within a few days after planting and possibly washed away the seeds as no seedlings sprouted in the plots. Therefore, in late October, restoration efforts required transplanting five seedlings from the germination experiments into each plot and individually staking the seedlings with biodegradable cloth.

The small white clusters of carrotlike flowers show harperella in full bloom on a site near the Chesapeake and Ohio Canal National Historical Park. Harperella is the only federally endangered plant species in the National Capital Region.







Dr. Elizabeth Wells (above left) and her assistant, Charlotte Marvil, lay out a plot for planting harperella on a gravel bar beside the Potomac River in C&O Canal National Historical Park. The plots are marked with 14-inch (35-cm) long

spikes and biodegradable flagging tape, using orange twine to crisscross the space about 8 inches (20 cm) above the surface.

Scientists do not fully understand the consequences of flooding during various stages of harperella's life cycle. Harperella tolerates or even requires some flooding during the winter and spring to deter weedy competitors from establishing populations on the gravel bars. However, flooding during seed maturation in late summer and autumn, when flower and fruit production occurs, has mixed consequences. By establishing and augmenting new populations downstream, minor floods of low volume appear to have significant, beneficial roles in seed dispersal in autumn. However, major floods of extended duration during autumn appear to obliterate the seeds. The typical three- or four-month period of flowering and fruiting from August until frost usually allows many opportunities for seed dispersal. Unfortunately, this year was notable for frequent massive

floods, including the September 18, 2003, flood that accompanied Hurricane Isabel. Field observations in 2003 suggest that harperella germination and establishment do not occur when water levels are unusually high, whereas vegetative reproduction may be favored during periods of extended flooding. Experiments are planned to test vegetative reproduction in harperella in 2004. ■

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## Donna Shaver returns to the National Park Service

Sea turtle biologist Donna Shaver returned to the National Park Service in October 2003 following a 10-year stint with the Biological Resources Division (BRD) of the U.S. Geological Survey (USGS). Shaver was transferred to the National Biological Service when it was established in 1993 along with approximately 200 NPS research-grade scientists and support staff and was later folded into USGS-BRD. Her "restoration" is one of just a few transfers of BRD research scientists back to the National Park Service and results from the USGS determination that Shaver's work is now at an applied state that better fits the park mission.

Shaver is the foremost expert on endangered Kemp's ridley sea turtles in the United States and a leader in sea turtle biology and recovery. She will continue the sea turtle research, monitoring, and conservation efforts that she helped pioneer at the park more than 20 years ago and continued to perfect while working for the USGS. Starting as a Student Conservation Association research associate in 1980, Shaver worked her way up to research biologist in 1993, and completed her doctorate in biology at Texas A&M University in 2000. Mike Soukup, NPS Associate Director for Natural Resource Stewardship and Science, considered Shaver's return very important in reestablishing the institutional knowledge and expertise of the successful sea turtle restoration program in the National Park Service. Shaver now serves as chief of the Division of Sea Turtle Science and Recovery at Padre Island National Seashore.



Sea turtle biologist Donna Shaver and former park superintendent Jock Whitworth release green sea turtle hatchlings at Padre Island National Seashore. Let go just 48 hours after hatching, the sea turtles immediately head to the surf, perhaps not to return to the park to nest for 30 years.

Padre Island is the site of a long-term effort to restore a nesting population of Kemp's ridley sea turtles, the most endangered sea turtles in the world. In a grand, international experiment from 1978 to 1988, Mexican biologists collected eggs from the species' primary nesting beach in Rancho Nuevo, Mexico; packed them in Padre Island sand; and shipped them to the national seashore. After hatching in captivity, the young turtles were released in hopes that they would imprint on the park and eventually return to nest. Shaver arrived two years after this project began and has been integral in shaping the course of the restoration since that time. After 10 years of searching, Shaver confirmed in 1996 the first returning Kemp's ridley sea turtles from the experiment. Eggs continue to be collected in Texas and are incubated at a temperature that encourages more females than males, a strat-

egy that she uses to help increase the number of breeding females and better match the natural sex ratio. Although the Kemp's ridley is still considered endangered, the Padre Island population has increased gradually. In 2003 a record 38 Kemp's ridley nests were documented in Texas, including 23 at the national seashore. Additionally, 55% of all Kemp's ridley nests recorded in the United States since 1989 have been at Padre Island National Seashore. The program now involves up to 20 nonpermanent NPS employees and 100 volunteers each year and is of high interest to locals, scientists, environmental groups, government bureaus, and the media. Based on her excellent work, credibility, and partnership building, Shaver has successfully attracted approximately \$2.6 million to the sea turtle program.

Shaver continues to coordinate research and restoration activities with many partners in the United States and Mexico. She is Texas coordinator of the Sea Turtle Stranding and Salvage Network, a member of the Kemp's ridley sea turtle working group and the Kemp's ridley recovery team, a board member of the International Sea Turtle Society, and a member of the IUCN (the World Conservation Union) Species Survival Commission—Marine Turtle Specialist Group. The National Park Service is proud to welcome her back. ■



# Regulations help endangered sea turtles make a comeback

By Darrell Echols and Ed Kassman

IN WHAT HAS NOW BECOME a familiar south Texas rite of spring at Padre Island National Seashore, “turtle patrollers” mount their ATVs and comb the beach for nesting Kemp’s ridley sea turtles, the most critically endangered sea turtle in the world. From the 1950s to the 1980s, humans caused the population of Kemp’s ridley sea turtles to decline nearly to the point of extinction. Through a remarkable international effort involving Mexico, the National Marine Fisheries Service, and the National Park Service, the turtles are making a comeback.

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A challenge in protecting their nesting sites is ensuring that heavy equipment being shuttled up and down the beach by oil and gas operators en route to production sites does not crush the turtles, their nests, or hatchlings, or impede hatchlings from getting to the ocean. Oil and gas rights existed at Padre Island long before Congress created this unit of the National Park System, and these rights are still held by private entities and the state. However, the park has skillfully applied regulations and well-tailored mitigation techniques to oil and gas operations, playing a key role in the Kemp’s ridley’s recovery.



Endangered Kemp’s ridley sea turtle numbers gradually continue to climb at Padre Island National Seashore. A key to this success has been the efforts of NPS turtle patrollers to locate nest sites (right) so that heavy equipment being shuttled up and down the beach by oil and gas operators en route to production sites does not crush the turtles, their nests, or hatchlings, or impede hatchlings from getting to the ocean. Another important mitigation measure is heavy equipment convoys led by NPS turtle patrol escorts (left).

A key right associated with mineral ownership is that of reasonable access across the surface to explore for, develop, and transport the oil and gas resources. If the National Park Service denied all surface access to the mineral rights holders, the United States would be required to purchase the mineral rights at fair market value. So, despite Padre Island National Seashore’s designation as a unit of the National Park System, and the United States’ ownership of the surface interest, mineral resources are still being developed in the unit.

Regulations promulgated in 1979 require that operators have a National Park Service–approved plan of operations, which will include resource protection measures, provide a reclamation plan, and file a suitable performance bond. Through this requirement the National Park Service can proactively ensure that operators avoid or mitigate expected impacts on park resources and values.

To protect the nesting Kemp’s ridley, for instance, an operator is required to comply with the following partial list of mitigation measures at Padre Island National Seashore:

- Operator’s employees and contractors must attend an NPS turtle training and awareness course, which includes identification of turtle tracks, a notification protocol to follow in the event that turtles or nesting grounds are located, and marking the location of tracks or nests if an employee or contractor is unable to stay on-site until official crew members arrive.
- During peak Kemp’s ridley nesting season, operators’ vehicle convoys will not leave before an NPS turtle patrol inspects the beach ahead of them and notifies operators that larger vehicles can travel the beach safely.



- ATVs and large trucks must drive no faster than 15 miles per hour.
- Trucks are required to drive above the “wet-line” on the beach so that turtle tracks can be identified.
- A backhoe or tractor must be stationed on the beach to smooth out ruts after having a monitor on an ATV check for nesting turtles or tracks.
- Larger vehicles are prohibited from traveling at night to minimize impacts on night-nesting turtles, which include the green, logger-head, hawksbill, and leatherback.

With these mitigation measures the park has successfully protected Kemp’s ridley nests. It has never documented a hatchling death, death of a nesting sea turtle, or crushing of a sea turtle nest by an oil and gas operator since the program began 25 years ago. In addition, the Kemp’s ridley population has slowly but steadily increased since the mid-1980s.

Although it is certain that the absence of mineral development at Padre Island National Seashore would lower the risk to the Kemp’s ridley’s recovery, the park has succeeded in fulfilling Congress’s directive to manage resources while recognizing the rights of mineral operators to access the surface and develop their property interest. ■

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## Oil and gas management plan for Padre Island National Seashore upheld in court

*By Darrell Echols and Ed Kassman*

On April 17, 2002, the Sierra Club filed suit in federal district court in Texas against the Secretary of the Interior, the National Park Service, and the U.S. Fish and Wildlife Service. The Sierra Club’s complaint alleged that the National Park Service violated section 7 of the Endangered Species Act when it prepared its oil and gas management plan and also when it approved two private oil and gas operations. Specifically, the Sierra Club claimed that the Park Service was not adequately protecting Kemp’s ridley sea turtles, a federally listed endangered species. The district court ruled in favor of the National Park Service, holding that the oil and gas management plan was not subject to judicial review and that the Park Service had acted reasonably when it approved operations at the two well sites. The court also noted that the Park Service has required the company drilling the wells to adhere to extensive mitigation to protect the turtles (see page 92). The Sierra Club appealed to the Fifth Circuit Court of Appeals, which affirmed the lower court’s decision. No appeal to the Supreme Court is expected.

Since 1979 the National Park Service has managed the exercise of nonfederal oil and gas rights to avoid or minimize damage to park resources and values. In 1995, private mineral owners at Padre Island National Seashore sued the park in federal district court challenging the park’s authority to regulate the exercise of private mineral rights. In that case, the district court ruled in favor of the National Park Service, and the Fifth Circuit Court of Appeals affirmed the lower court’s determination. The Fifth Circuit’s ruling in the Sierra Club’s most recent challenge further assures Padre Island National Seashore and the National Park Service of the effectiveness of regulatory authority regarding private oil and gas activities to protect all park resources, including the endangered Kemp’s ridley sea turtle. ■

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